
SAE Government and Industry Meeting
Frontal Crash Protection

**Real World Experience with
Event Data Recorders**

May 14, 2001

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Event Data Recording Topics



- **EDR Working Group**
- **EDR Field Data Collection**
- **Future EDR Programs at NHTSA**



EDR Working Group



- In early 1998, the Motor Vehicle Safety Research Advisory Committee (MVSRAAC) Crashworthiness Subcommittee organized a working group to study EDRs.
- The main objective of the Working Group was to facilitate the collection and utilization of collision avoidance and crashworthiness data from on-board Event Data Recorders.

EDR Working Group



- **To facilitate achieving this objective, the WG developed a set of sub-objectives, which include:**
 - **1) status of EDR technology;**
 - **2) data elements;**
 - **3) data retrieval;**
 - **4) data collection and storage;**
 - **5) permanent record;**
 - **6) privacy and legal issues;**
 - **7) customers and uses of EDR data; and**
 - **8) demonstration of EDR technology.**

EDR Working Group



- The working group has met routinely, about three times per year, through the end of 2000.
- The working group is currently documenting their findings in a technical report that will be published in 2001.
 - All materials provided to the working group, along with the final approved minutes from each meeting, were placed in the Department of Transportation's Document Management System (DMS), docket NHTSA-99-5218.
 - These dockets are viewable and printable from the DMS, which can be located using an Internet browser at <http://dms.dot.gov>. (Search for docket 5218.)

EDR Program at NHTSA: *Field data collection*



- NHTSA currently collects EDR crash data in three major vehicle crash programs:
 - NASS-CDS – A national statistically sampled data base, currently collecting data on about 4,000 crashes each year at 24 locations around the U.S.;
 - SCI – A collection of targeted crash investigations looking at emerging safety issues, and;
 - CIREN – A system of crash investigations conducted at hospitals, collecting about 400 cases per year.

EDR Program at NHTSA: *Field data collection*



EDR Download Success by Manufacturer, Crash Program, and Downloading Agency

| Program | GM (read by NHTSA/EISS) | | FORD | | Totals | |
|---------|-------------------------|--------|------|-------|--------|-------|
| | Att. | Comp. | Att. | Comp. | Att | Comp. |
| SCI | 7[18] | 7[18] | 28 | 28 | 53 | 53 |
| NASS | 41[1] | 34[1] | 6 | 5 | 48 | 41 |
| Totals | 48[19] | 41[19] | 34 | 33 | 101 | 94 |

EDR Program at NHTSA: Field data collection



Methodology:

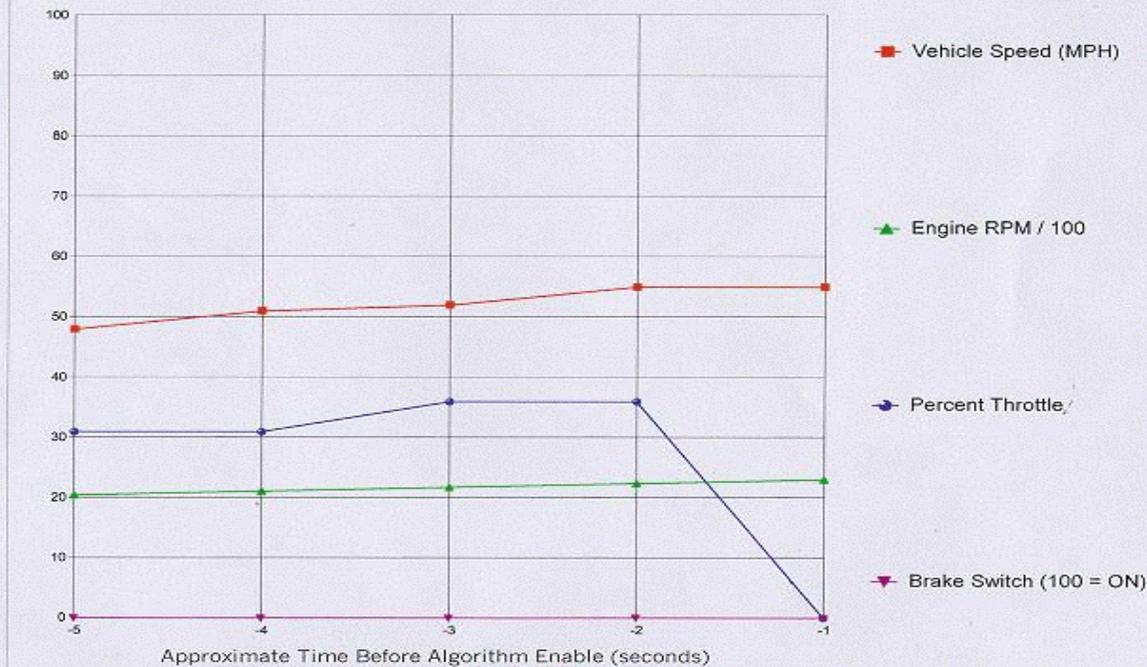
- GM:
 - Sensing and Diagnostic Module (SDM):
 - Primary function is to control the deployment of the occupant protection systems.
 - This system records a longitudinal acceleration.
 - Data related to the driver and passenger air bag deployment including:
 - 5 seconds of pre-crash data
 - vehicle speed, engine RPM, engine throttle opening, and brake application
 - Up to 300 milliseconds of crash pulse
 - Driver Seat belt use



EDR Program at NHTSA: Field data collection



1GTGK24U8YE201466 Deployment Data



EDR Program at NHTSA: Field data collection



| 1GTGK24U8YE201466 System Status At Deployment | |
|-----------------------------------------------|---------|
| SIR Warning Lamp Status | OFF |
| Driver's Belt | BUCKLED |
| Passenger Front-Air Bag | OFF |
| Ignition Cycles At Deployment | 1022 |

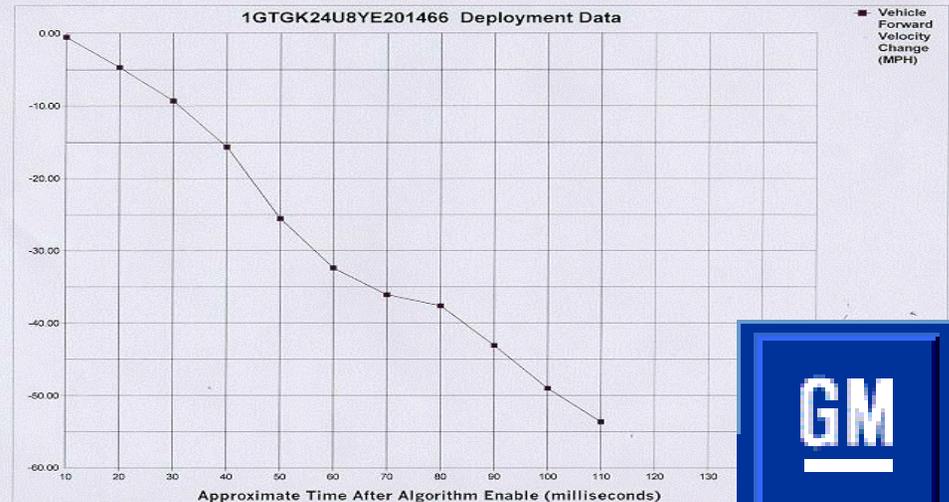
| PRE-CRASH DATA | | Electronic Data Validity Check Status = VALID | | |
|-------------------|---------------------|-----------------------------------------------|------------------|---------------------|
| Seconds Before AE | Vehicle Speed (MPH) | Engine Speed (RPM) | Percent Throttle | Brake Switch Status |
| -5 | 48 | 2048 | 31 | OFF |
| -4 | 51 | 2112 | 31 | OFF |
| -3 | 52 | 2176 | 36 | OFF |
| -2 | 55 | 2240 | 36 | OFF |
| -1 | 55 | 2304 | 0 | OFF |



DEPLOYMENT DATA

| Milliseconds After AE | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 |
|-----------------------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| Velocity Change (MPH) | -0.50 | -4.67 | -9.28 | -15.65 | -25.52 | -32.32 | -36.05 | -37.59 | -43.07 | -49.00 | -53.61 |

| | |
|-----------------------------------------------------------|-----|
| Time Between Deployment and Near Deployment Events (msec) | N/A |
|-----------------------------------------------------------|-----|



EDR Program at NHTSA: *Field data collection*



Methodology:

- Ford:
 - **Restraint Control Module (RCM)**
 - Primary function is to control the deployment of the occupant protection systems.
 - This system records longitudinal and lateral acceleration.
 - Data related to the driver and passenger air bag deployment including:
 - 80 milliseconds of crash pulse
 - Deployment strategy of the dual-stage air bag system
 - Seat belt use
 - Pre-tensioner operation
 - Driver seat position



EDR Program at NHTSA: Field data collection



EDR Control Module Data

| | | | |
|--------------------------------------------------|--------------|--------------------|-----|
| Data Validity Check: | Valid | EDR Model Version: | 141 |
| Left (Driver) Side Bag Deployment Time (ms): | Not Deployed | | |
| Right (Passenger) Side Bag Deployment Time (ms): | Not Deployed | | |
| Passenger Airbag Switch Position During Event: | N/A | | |
| Diagnostic Codes Active When Event Occurred: | 0 | | |

Algorithm Times Actual initiation depends on restraint system status (below).

| | ms |
|-------------------------------------------------------|----|
| Time From Algorithm Wakeup to Pretensioner: | 8 |
| Time From Algorithm Wakeup to First Stage - Unbelted: | 10 |
| Time From Algorithm Wakeup to First Stage - Belted: | 21 |
| Time From Algorithm Wakeup to Second Stage: | 0 |

Restraint System Status

| | |
|----------------------------------------|-------------|
| Driver Seat Belt Buckle: | Engaged |
| Passenger Seat Belt Buckle: | Not Engaged |
| Driver Seat Track In Forward Position: | No |
| Passenger Seat Weight Switch Position: | N/A |



Deployment Initiation Attempt Times

| | Driver | Passenger |
|----------------------------------------------------------------|----------|-----------|
| Time From Algorithm Wakeup to Pretensioner Deployment Attempt: | 8 | Unbelted |
| Time From Algorithm Wakeup to First Stage Deployment Attempt: | 21 | 21 |
| Time From Algorithm Wakeup to Second Stage Deployment Attempt: | Disposal | Disposal |

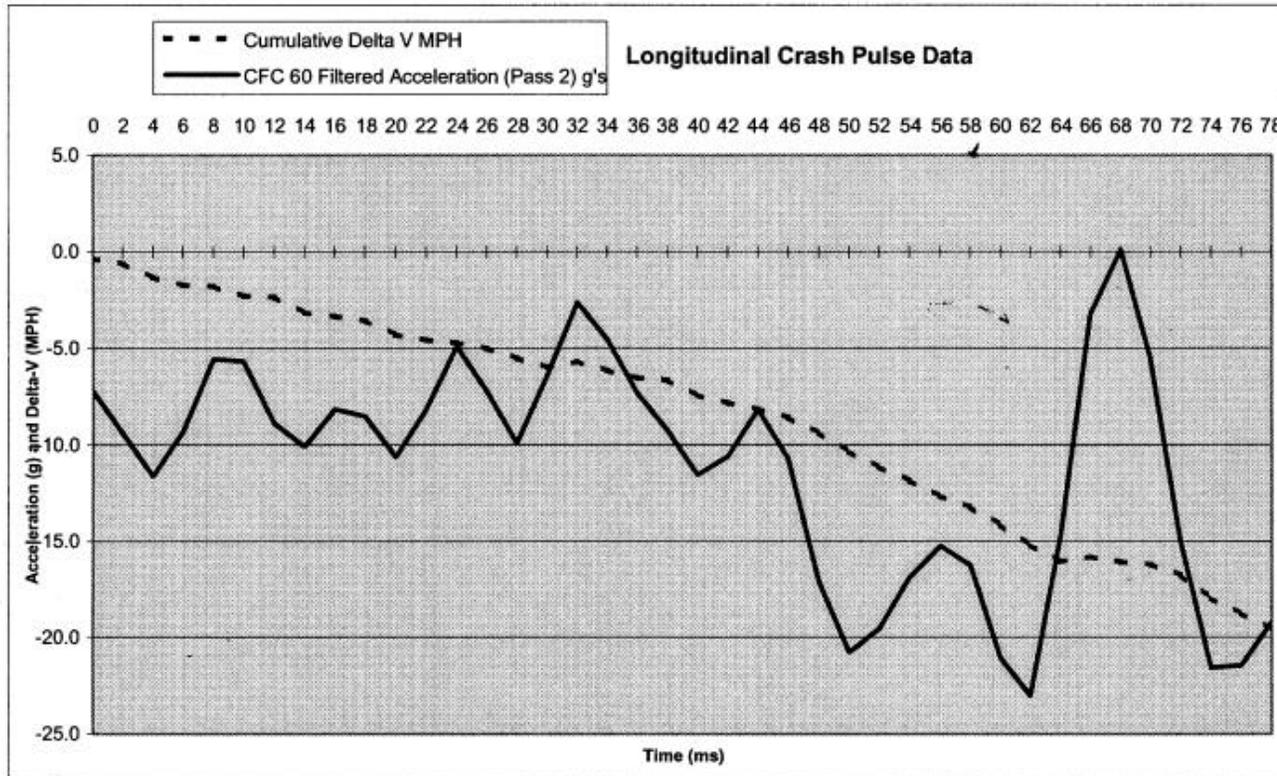


EDR Program at NHTSA: Field data collection



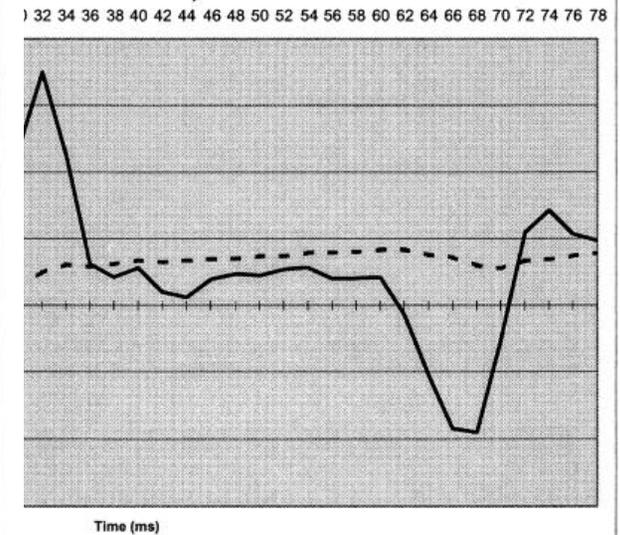
Longitudinal Cumulative Delta-V

| Time (ms) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 78 |
|---------------|------|------|------|------|------|-------|-------|-------|-------|
| Delta-V (MPH) | -0.4 | -2.3 | -4.3 | -5.9 | -7.4 | -10.3 | -14.1 | -16.2 | -19.5 |



| 30 | 40 | 50 | 60 | 70 | 78 |
|-----|-----|-----|-----|-----|-----|
| 0.7 | 1.4 | 1.5 | 1.7 | 1.1 | 1.6 |

Lateral Crash Pulse Data



EDR Program at NHTSA: What We Have Learned



- Some EDR output data may be lost or questionable.
 - Due to loss of power loss and sensor problems.
- Enhancement of the crash reconstruction.
 - Crash pulse, time to deployment, restraint usage, etc
- Improvement in data quality.
 - Used for validation of data.
 - Improves data completion.

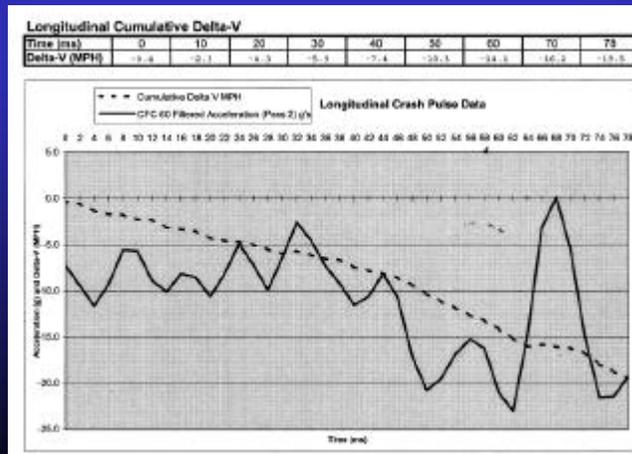


EDR Program at NHTSA: What We Have Learned



- The most effective method to observe and/or measure the performance of **Advanced Occupant Protection Systems** is through the EDR data.
 - Deployment logic

| EDR Control Module Data | | |
|--------------------------------------------------------------------------------------|--------------|-----------|
| Data Validity Check: | Valid | |
| EDR Model Version: | 141 | |
| Left (Driver) Side Bag Deployment Time (ms): | Not Deployed | |
| Right (Passenger) Side Bag Deployment Time (ms): | Not Deployed | |
| Passenger Airbag Switch Position During Event: | N/A | |
| Diagnostic Codes Active When Event Occurred: | 0 | |
| Algorithm Times Actual values depend on restraint system status during event. | | |
| Time From Algorithm Wakeup to Pre-deployment: | 8 | |
| Time From Algorithm Wakeup to First Stage - Unlatched: | 10 | |
| Time From Algorithm Wakeup to First Stage - Seeded: | 21 | |
| Time From Algorithm Wakeup to Second Stage: | 3 | |
| Restraint System Status | | |
| Driver Seat Belt Buckle: | Engaged | |
| Passenger Seat Belt Buckle: | Not Engaged | |
| Driver Seat Track in Forward Position: | No | |
| Passenger Seat Weight Switch Position: | N/A | |
| Deployment Initiation Attempt Times | | |
| | Driver | Passenger |
| Time From Algorithm Wakeup to Pre-deployment Deployment Attempt: | 3 | Unlatched |
| Time From Algorithm Wakeup to First Stage Deployment Attempt: | 21 | 21 |
| Time From Algorithm Wakeup to Second Stage Deployment Attempt: | Unlatched | Unlatched |



Other Activities with AOPSS **Coordination with Industry**



- Working with Crash Investigators, Engineers and Designers
 - **Case-by-Case Evaluation on**
 - EDR Readouts
 - Real World Performance of the Advanced Occupant Protection System Technologies



FUTURE: EDR Program at NHTSA



■ Future

- **NHTSA will continue to Research**
- Standardized EDR data set
- Program to supply EDR readers and Training to law enforcement.
- Add EDR output to Police Crash Reports.
- Severity Indicator in FARS.

Questions

